Yacht Devices

User Manual

NMEA 2000 Wi-Fi Gateway YDWG-02
also covers models
YDWG-02R, YDWG-02N
Firmware version
1.71

2024

Package Contents

Device	1 pc.
This Manual	1 pc.
Paperclip for reset	1 pc.
NMEA 2000 Drop Cable	not supplied

Note: Device can be connected to the network backbone directly, without an NMEA 2000 drop cable.

Contents

Introduction

The NMEA 2000 Wi-Fi Gateway (hereinafter Gateway or Device) allows you to see data from an NMEA 2000 marine digital network on a PC or smartphone. With it, you get marine network data including vessel course, speed, position, wind speed and direction, water depth, AIS messages from vessels and aircrafts and other navigation data in popular software applications.

The Web Gauges page of Device's web interface allow managing of digital switching equipment and real time viewing of vessel data using a web browser on PC, laptop, tablet or smartphone and can replace instrument displays. No internet connection or app installation required.

NMEA 0183 applications can use $PCDIN and $MXPGN sentences to transmit raw NMEA 2000 messages to and from NMEA 2000. This allows receiving of extended engine data, data from tanks and batteries, and gives control over NMEA 2000 digital switching equipment.

The Device creates its own Wi-Fi network (with range of about 30 meters in open spaces) or it can be connected to an existing Wi-Fi network. In the second case, coverage depends on the base network coverage; laptops and PCs can be connected to Wi-Fi routers (and the Gateway services) by Ethernet; and you can configure remote access to the Gateway over the Internet.

To configure the Gateway, you need any Wi-Fi enabled device (laptop or smartphone) with any web browser. The Device's settings can be reset to factory values using the hidden reset button (a paper clip is required, supplied with the Device).

The Gateway supports TCP and UDP network protocols (both can be enabled at the same time). For UDP protocol, the number of clients (physical devices or software applications) is unlimited.

A pair of Wi-Fi Gateways can act as an NMEA 2000 wireless extender and allows joining of two or more physical networks. To pair the gateways, you need to set up both using UDP protocol and set the same port number.

The Device has a bi-directional converter between NMEA 2000 and NMEA 0183 protocols. NMEA 0183 protocol has been widely supported in marine applications since the last millennium. So, the Device is compatible with virtually all marine software, except applications especially designed for use only with specific hardware. A powerful system of data filters allows configuring data output for feature-limited mobile applications.

The Gateway also supports RAW protocol, which is supported in a popular Expedition 10 and CAN Log Viewer. It allows transferring of any NMEA 2000 messages (including proprietary messages) to an application and vice versa. This protocol is open and is also supported by our USB Gateway. We hope that it will be popular among software developers, as it is very simple and free.

We hope that you'll like this tiny and low power Device. Thank you for purchasing our product and happy voyages!

Warranty and Technical Support

1. The Device warranty is valid for two years from the purchase date. If a Device was purchased in a retail store, the sales receipt may be requested when applying for a warranty claim.

2. The Device warranty is terminated in case of this Manual instructions violation , case integrity breach, or repair or modification of the Device without the manufacturer's written permission.

3. If a warranty request is accepted, the defective Device must be sent to the manufacturer.

4. The warranty liabilities include repair and/or replacement of the goods and do not include the cost of equipment installation and configuration, or shipping of the defective Device to the manufacturer.

5. Responsibility of the manufacturer in case of any damage as a consequence of the Device's operation or installation is limited to the Device cost.

6. The manufacturer is not responsible for any errors and inaccuracies in guides and instructions of other companies.

7. The Device requires no maintenance. The Device's case is non-dismountable.

8. In the event of a failure, please refer to Appendix A before contacting technical support.

9. The manufacturer accepts applications under warranty and provides technical support only via e-mail or from authorized dealers.

10. The contact details of the manufacturer and a list of the authorized dealers are published on the website: https://www.yachtd.com/.

I. Product Specification
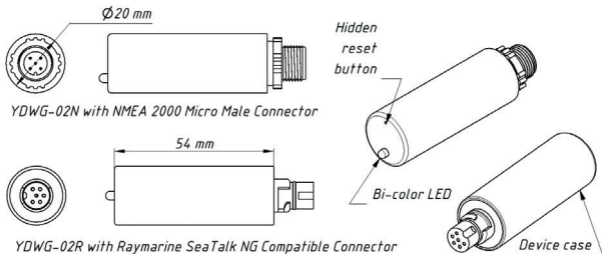

Figure 1. Drawing of YDWG-02N and YDWG-02R models of Gateway

Our devices are supplied with different types of NMEA 2000 connectors. Models containing R in the suffix of model name are equipped with NMEA 2000 connectors and are compatible with Raymarine SeaTalk NG. Models containing N in the suffix are equipped with NMEA 2000 Micro Male connectors. See connector drawings in Appendix B.

Device parameter	Value	Unit
Supply voltage (from NMEA 2000 network)	7..17	V
Current consumption	43	mA
Protection against reverse polarity	Yes	—
Load equivalency number	1	LEN
Wi-Fi module 2.4 GHz	802.11b/g/n	—
Wi-Fi internal antenna range (open space)	30 / 100	m / feet
Wi-Fi connections in Access Point mode (max.)	3	—
TCP connections from applications (max.)	9	—
UDP clients (applications or devices)	Unlimited	—
Device case length	54	mm
Weight	18	gr
Operating temperature range	-20..55	°C

The Wi-Fi antenna is located inside under the LED.

CE Yacht Devices Ltd declares that this product is compliant with the essential requirements of EMC directive 2014/30/EU and radio and TTE directive 1999/5/EC.

Dispose of this product in accordance with the WEEE Directive. Do not mix electronic disposal with domestic or industrial refuse.

II. Device Installation and Connection to NMEA 2000 Network

The Device requires no maintenance. When deciding where to install the Device, choose a dry mounting location. Avoid places where the Device could be flooded with water, as this can damage it.

Note that conductive materials (metals) weaken the Wi-Fi signal or may even completely block it. Do not place the Device behind a metal bulkhead. Metals reflect radio signals, and you should avoid (if possible) placing the Device in front of metal bulkheads also. Plastic or wood (and many other non-conductive materials) did not significantly affect the signal.

The Device is well-suited for fiberglass and plastic sailing yachts as well as motor boats up to 65 feet (20 m) in length. With good signal strength over a 30m area in open space, the Gateway provides good coverage inside and outside the boat.

On metal vessels or large vessels, an external Wi-Fi router may be required. In this case, coverage depends on the coverage of the base network, which can contain multiple Wi-Fi routers connected by Ethernet (for example). PCs and laptops can be connected to routers (and to the Gateway services) by Ethernet.

The Device is directly connected to the NMEA 2000 network backbone without a drop cable. Before connecting the Device, turn off the bus power supply. Refer to the manufacturer's documentation if you have any questions regarding the use of connectors:

- SeaTalk NG Reference Manual (81300-1) for Raymarine networks;
- Technical Reference for Garmin NMEA 2000 Products (190-00891-00) for Garmin networks.

After connecting the Device, close the lock on the connection to ensure it is water resistant and firmly secured.

When powered on, the Device produces a single green flash to indicate that power is supplied. After that, the Gateway will produce a series of four flashes every five seconds (see details in Section VI). A new Device usually flashes GREEN-GREEN-RED-GREEN after the installation, meaning that it is connected properly.

You can also check the NMEA 2000 connection and firmware version from a chart plotter. Please, see Section IX for details.

III. Wi-Fi Settings

The Device can operate in either Access Point mode (which is the factory default) or in Client mode — when connected to an existing Wi-Fi network. To configure the Gateway, you need any Wi-Fi enabled device (laptop or smartphone) with a web browser.

> ⚠️ *The internal web server of the Gateway has limited possibilities and simultaneous access from multiple devices is not recommended. Updating settings of NMEA servers can cause termination of the current TCP data connections.*

1. Access Point mode

In Access Point mode the Device creates a Wi-Fi network with name (SSID) «YDWG» and password «12345678». To access the Device web interface, connect to this Wi-Fi network and enter http://192.168.4.1 in a web browser. Use login «admin» and password «admin» (without quotes) to log in to the Device web interface. The Device's web interface includes a navigation menu on the left. In the mobile version, this menu is accessible via the «hamburger» icon in the top left corner. On the «Wi-Fi Access Point» page, you can change the Wi-Fi network name (SSID) and password, set the Wi-Fi authentication algorithm, select the desired Wi-Fi channel and make the network hidden.

Note that hidden networks will not appear in the list of available Wi-Fi networks on client devices. However, you can still connect to them by manually entering their name (SSID) and password in the Wi-Fi connection settings on the client devices.

The Device's default Wi-Fi channel is 1. If you experience an unstable Wi-Fi connection in an area with many deployed Wi-Fi networks, such as a marina, try changing the

Wi-Fi channel. This issue may be caused by congestion or signal interference on the channel. To resolve this, assess nearby Wi-Fi network channels using a Wi-Fi scanner mobile app that shows nearby Wi-Fi channel usage and signal strength and select the most free channel. Please note that as of early 2024, all countries except the US and Canada allow channels 1-13, where only channels 1-11 are allowed for use.

> ⚠️ *We strongly recommend changing the default Wi-Fi password. A hijacker can take control of autopilot and other important ship systems. In the air drone era, this can happen even far from shore.*

Up to three Wi-Fi connections are supported in Access Point mode. You can switch the Device to Client mode to bypass this limitation.

2. Client mode

Figure 2. Wi-Fi details on IPhone 6

In Wi-Fi Client mode, the Device connects to an existing Wi-Fi network. To switch the Device to this mode from the default Access Point mode, use the «Wi-Fi Client» page in the Device's web interface.

To connect to your Wi-Fi network, you can either scan for available networks or manually enter your network name (SSID) and password. Once the scan is complete, select your Wi-Fi network from the list using the radio button and enter its password.

By default, Device will use DHCP to get IPv4 address automatically from the Wi-Fi Router. In that case, Router will assign IP address randomly from the allowed DHCP address range.

To access the Device, you will need to get its new IPv4 address. This can be done by accessing Gateway's Wi-Fi clients list and checking for the Device MAC address — the one which is displayed on the «Wi-Fi Client» page, «Wi-Fi State» section. If your Router lacks this feature, you can perform Wi-Fi network IPv4 range scan for open ports 80 (default Device web-interface port) and 1456 (default Device Server #1 port) using e.g. Zenmap NMAP GUI or similar software.

Many Routers support «Static DHCP» (or «DHCP Tethering») feature, which forces Router to always give the Device the same fixed IPv4 address over DHCP, Device will be identified by router via its MAC address. Note that the Gateway has two different MAC addresses, one for the Access Point mode and another for Client mode. You should use the MAC address given on «Wi-Fi Client» page, «Wi-Fi State» section for DHCP Tethering. If you do not remember your router's Wi-Fi network IP settings, you can quickly check them by connecting a mobile device or laptop to the router's Wi-Fi in DHCP mode and then checking the obtained IP settings. Refer to Figure 2 and note that the Gateway address is 192.168.4.1, and the subnet mask is 255.255.255.0 (CIDR /24 subnet). The smartphone has been assigned the IP address 192.168.4.3. To avoid

conflicts, it is recommended to assign the Device IP address from the same subnet but with a different address, such as 192.168.4.100. Contact your router administrator or refer to your router documentation if you have problems with the Wi-Fi setup. The «Save» button will save the settings in the EEPROM and the settings will be applied the next time you connect to the Wi-Fi network. The «Save & Apply» button saves settings and immediately attempts to apply them if the Gateway is already in Client mode.

When all necessary settings are entered, click «Connect» button to switch Device to Wi-Fi Client mode and connect to chosen Wi-Fi network. Check the Device's LED indication to make sure the correct Wi-Fi mode is selected and the connection status is OK (refer Section VI).

> ⚠️ *If the Gateway was previously in Access Point mode, it will shut down the «YDWG» network upon successful connection. Your client device, such as a smartphone or laptop, may continue searching for a non-existent network, requiring you to manually change the and enter the new IP address of Device web interface in the browser.*

In our Static IP configuration example above, we have connected the Device to WiFi network «GG» with manually set IP address 192.168.4.100. To access the Device web-interface, connect smartphone or laptop to Wi-Fi network «GG» and enter http://192.168.4.100 in the web-browser address bar.

3. What to do if the Device is not accessible

There many possible reasons why you may not be able connect to the Gateway after changing settings. Check the following:

- if Device LED flash #1 shows desired Wi-Fi operation mode (Access Point vs Client, refer Section VIII)?

- if Device LED flash #2 shows bad Wi-Fi connection status (refer Section VIII)?

- are you using DHCP or Static IP? If DHCP, have you set up «DHCP Tethering» («Static DHCP») on the Router correctly?

- have you set correct IP address, mask and gateway (matching your Wi-Fi router settings) before switching to Client mode?

- do your router's security settings block IP connections between Wi-Fi clients, e.g. is «Wi-Fi isolation» enabled?

If you cannot diagnose what is wrong, you can reset the Device's settings (see Section VII) and the Device will be returned to Access Point mode. You can connect to «YDWG» network again and try to change the settings one more time.

4. Other important settings

> ⚠ *Change the default web-interface access password on the «Administration» page! Do not forget to write it down in boat's Technical Documentation so you can easily access it later!*

> ⚠ *If you will use the Device in Access Point mode, change the default Access Point Wi-Fi passphrase! Do not forget to write it down in boat's Technical Documentation so you can easily access it later!*

In some network configurations, access to network port 80, which is the default HTTP port of the Device web-interface, may be limited. Alternatively, you may need to use a different port, say, if you use port forwarding on the router. You can change the Device web-interface HTTP port on the Device's «Home» page. For instance, if you set the port to 8080 (alternative HTTP port), you will need to explicitly add that port address to the Device's web-interface URL, e.g.: http://192.168.4.1:8080.

IV. Configuration of Application Protocols
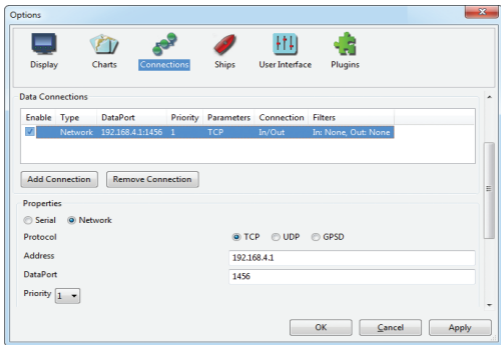
Figure 3. Settings of OpenCPN application

Most marine applications support both TCP and UDP network protocols. TCP is a connection-oriented protocol. This means that the receiver must confirm reception of data before it gets the next packet of data, otherwise the sender repeats the transmission after a timeout. So, the second TCP connection doubles the network traffic and CPU load, despite the fact that both clients receive the same data.

UDP is a connectionless protocol; any number of clients can listen to data broadcasted from a specified port without any additional load on the server and without increasing the actual network traffic. We recommend using UDP protocol where possible, because the resources of the Device's CPU are limited.

The Gateway supports RAW and NMEA 0183 data protocols. The RAW protocol is supported in Expedition 10 and CAN Log Viewer. This protocol is very simple, open and also supported by our USB Gateway YDNU-02. We hope that this protocol becomes popular among software developers.

NMEA 0183 is supported in virtually all marine applications. The Gateway contains a bi-directional converter between NMEA 0183 and NMEA 2000 and has a flexible system of message filters (see Section V).

On the «NMEA Server» page on the web interface you can setup up to three server ports (see Figure 4). If TCP network protocol is selected, up to three connections (from three different applications on one device, or from three devices with one marine application running on each) are allowed at the same time. So, three servers allow nine connections in total.

In the case of using UDP protocol, the number of devices or applications used the data port is not limited. We recommend using UDP protocol when possible.

Server port can be configured as bi-direction, read-only (Transmit Only) or write-only (Receive Only). We recommend configuring data ports as read-only if possible, to prevent network flooding from incorrectly configured applications.

Server 3 also supports «Debug» data protocol, designed to diagnose issues with software applications. This protocol is described in Section VIII.

Figure 4. Gateway server settings

With the factory settings, Gateway has the Server #1 enabled and pre-configured to use TCP port 1456 and the NMEA 0183 data protocol. To connect your application to the Gateway with factory settings:

- connect your laptop or mobile device to YDWG network;
- set the IP address 192.168.4.1 in the application settings;
- specify the TCP protocol and port 1456 in the application settings.

The settings on the «NMEA Settings» page are designed to control an autopilot by NMEA 0183 protocol and tune NMEA 0183 output settings, see Section X for details.

V. NMEA 0183 and NMEA 2000 Message Filters

The Device has 14 filter lists which allow limiting the set of messages passed from the NMEA 2000 network to a PC or mobile application (transmit filters) and messages passed from the application to the NMEA 2000 network (receive filters).

Each NMEA server has four filter lists: two for incoming and outgoing NMEA 0183 messages, two for incoming and outgoing NMEA 2000 messages (used for RAW protocol). Which filter is used depends on the server data protocol settings defined on the «NMEA Servers» page. There are 12 filter lists in total.

The Device also has two «Global» filter lists, which define what NMEA 2000 messages can be passed from the network to internal NMEA servers and what NMEA 2000 messages can be sent by internal NMEA servers to the NMEA 2000 network.

Each filter list has a switchable type: WHITE or BLACK. A message is passed thru the WHITE filter if it contains a record matched with a message. And the reverse for BLACK. In the factory settings, all filter lists are empty and are of BLACK type, so all messages are passed through the filters.

1. Syntax of NMEA 0183 filters

NMEA 0183 filters contain 3-char NMEA 0183 sentence formatters separated by a space character. According to the standard, an NMEA 0183 sentence starts with a $ or ! symbol, followed by a two-character talker ID and a 3-char sentence formatter. These elements are followed by data fields (after the comma).

The sentence ends by a checksum after the * (asterisk) symbol. Gateway with factory settings using «YD» talker ID, it can be changed on the «NMEA Settings» page (see X.2). The Device uses 3-char sentence formatters only for filtering. The following sentences matches to GLL and VDM records (sentence formatters):

```
$GPGLL,4146.5894,N,07029.6952,W,173412.02,A*15

!AIVDM,1,1,,B,13A0B20vim1560hOldUqEWQnH<2K,0*4D
```

Example of correct NMEA 0183 filter text:

```
GLL VDM DPT
```

2. Syntax of NMEA 2000 (RAW protocol) filters

You should be familiar with the NMEA 2000 Standard (can be purchased from National Marine Electronics Association, https://www.nmea.org/) to operate with NMEA 2000 filters.

These filters actually contain pairs of 29-bit message identifiers and a mask. The identifier is compared by processing the NMEA 2000 message identifier and the second value (mask) defines the comparison concerning which bits are significant. The identifier contains a PGN (Parameter Group Number, described in NMEA 2000 Standard) and a source device address. You can use decimal and hexadecimal numbers (which start with a 0x prefix).

To simplify defining filters, it is also allowed to set filters using PGN only. The filter string contains records separated by comma. Records contain an identifier and mask separated by space, or a PGN number.

Example of correct filter:

```
0x1FD0700 0x1FFFFFF, 130310, 1 255, 130311
```

This filter matches with messages with PGN 130311 (0x1FD07) sent by the device with address 0, PGN 130310 (sent by any device), messages sent by a device with address 1 («1 255» is another form of the record «0x0000001 0x00000FF»), and PGN 130311 (sent by any device).

3. Configure filters

We recommend using Gateway filters only when filtering is not available in software applications (unfortunately, this is not rare in mobile applications). Read Section VIII to learn how to tune filter settings.

To configure a filter, open the «NMEA Filters» page on the web interface and select it with «Server», «Data Protocol» and «Filter» combo boxes. Switch the filter type to required, enter a filter string and click «Update» (to discard changes just switch to another filter). On update, the Device parses the string and returns the effective settings back. Incorrect strings are ignored by the Device.

Changes take effect immediately, and if you have diagnostics data opened in another browser window (see Section VIII), you can monitor the effect of changes in real time.

NMEA Data Filters

Each data server has four filter lists: two for incoming and outgoing NMEA 0183 messages, and two for incoming and outgoing NMEA 2000 messages (used for RAW protocol). Which filter is used depends on the server data protocol settings.

The Device also has two "Global" filter lists, which define what NMEA 2000 messages can be passed from the NMEA 2000 network to the Gateway and in the reverse direction.

NMEA 0183 filters contain 3-char NMEA 0183 sentence formatters separated by a space character. NMEA 2000 (RAW protocol) filters contain PGNs or pairs of 29-bit message identifiers and a mask, separated by a comma. Example of NMEA 0183 and NMEA 2000 (RAW) filters:

- GLL VDO VDM DPT
- 0x1FD0700 0x1FFFFFFF, 130310, 1 255, 130311

Choose Filter:

Server	Data Protocol	Filter
Server #1	NMEA 0183	Transmit

Define Filter Settings:

Filter Type	Filter Settings
Black	DBS DBT HDT

Update

Figure 5. Filter configuration page

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VI. LED Signals

The Device is equipped with a bi-color LED that indicates the Device's state. At power on, the Device produce a single green flash to indicate that power is supplied.

#	Meaning	GREEN	RED
1	Wi-Fi Configuration	Gateway is configured to use its own Wi-Fi network named «YDWG» (SSID), Access Point mode.	The Gateway is configured to use the boat's existing Wi-Fi network, Client mode.
2	Wi-Fi State	The state of Wi-Fi link is normal.	Wi-Fi link is not established yet or some error happen (cannot connect to existing Wi-Fi network, wrong password, etc.).
3	TCP Connections	Some clients are connected to Gateway services by TCP protocol. When the web interface is browsed, the connection exists only a short period when page is downloading from the server.	No TCP connections are open (but applications can receive data by UDP protocol at the same time).
4	NMEA 2000 State	Data was received or sent to the NMEA 2000 network.	No data was received or sent to the NMEA 2000 network.

During normal operation, the Gateway produces a series of four flashes every 5 seconds.

With the factory settings, the Gateway should flash GREEN-GREEN-RED-GREEN, and when you open the web interface in the web browser (http://192.168.4.1), the Device will blink all green while pages are loading.

LED signals during device reset using the hidden reset button are described in Section VII.

LED flashes during firmware update procedure are described in Section IX.

VII. Settings Reset and Hardware Reset

Insert the paper clip (at a right angle to the device face) in the small hole at the end plate of the Gateway. The Gateway LED will constantly shine red when the hidden button under the hole is pressed.

Wait 2-3 seconds and the LED will change from red to green. Release the button to reset the Device's settings. Otherwise, the LED will become red 2-3 seconds later. Keep the button pressed ten seconds more, and the LED becomes green. Release the button to complete a hardware reset of Device. Alternatively, wait two seconds, and the LED color returns to red.

Note that nothing happens if you release the button when the LED signal is red. The settings reset occurs if you release the button during the first green light period, and the hardware reset occurs on the second period.

During settings reset, the Device changes all settings to factory values (returns to Access Point Mode, network SSID to «YDWG»), and the Device will produce fast green flashes for 2-3 seconds, then reboot.

During hardware reset, the Gateway returns to the factory programmed firmware version (the Device always keeps a copy of this version in EEPROM) and to the factory settings. LED signals during firmware updates are described in Section IX.

Hardware reset is normally not required. It can be used for firmware rollback.

VIII. Diagnostics Data Recording

Diagnostics is designed to troubleshoot issues with software applications. A log contains all sent and received NMEA 2000 messages and all data sent and received from and to the NMEA server #1 port (see Section IV). The NMEA server #3 can be configured to send log data in a real time to a web browser or terminal application.

1. Configure problem application to use port of server #1.

2. To get the diagnostics log, configure server #3 port to the «Debug» data protocol (it is TCP network protocol).

3. If the Gateway has the address 10.1.1.1 and server #3 port has a number 1500, type http://10.1.1.1:1500 in browser address bar (experienced users can also use terminal applications to get data from this port).

Press the «Stop» button in the browser (or the Esc button in some browsers) when enough data is downloaded and saves the log to disk. Some mobile browsers do not allow saving of files and we recommend using a laptop or PC to record diagnostics data. Some web browsers may try to download the web page again while saving. In this case, you can use the clipboard (Copy All and Paste commands of operating system) and text editor to save the data to a file.

If you need to record NMEA 2000 data only, you can use CAN Log Viewer software.

For more details refer to our FAQ: https://www.yachtd.com/faq/.

10:15:23.827 R 0DF010A3 FF FF 23 42 FE 7E B7 11
10:15:23.829 R 09FD0205 4E 47 00 F8 76 FA FF FF
10:15:23.874 R 09F10D00 00 F8 FF 7F B3 06 FF FF
10:15:23.937 R 09FD0205 4F 47 00 BE 7B FA FF FF
10:15:23.941 R 09F503A3 FF FF FF E3 00 FF FF FF
10:15:23.984 R 09F10D00 00 F8 FF 7F B3 06 FF FF
10:15:24.030 R 09FD0205 50 47 00 78 7E FA FF FF
SRV[0] TX:
$YDGSV,3,1,11,13,69,279,35,28,58,135,35,30,52,075,35,20,39,275,30*7B
$YDGSV,3,2,11,05,35,213,22,15,33,294,28,07,22,073,22,08,16,037,30*7B
$YDGSV,3,3,11,21,07,311,18,18,07,328,21,27,03,009,28,,,,*4C
$YDGGA,081523.82,5507.9950,N,01539.8625,E,1,10,1.00,1.94,M,,M,,*76
$YDHDG,299.3,,,4.3,E*39
$YDDPT,93.07,0.00,*4C
$YDVTG,299.3,T,295.0,M,4.5,N,8.4,K,A*2B
SRV[0] TX:
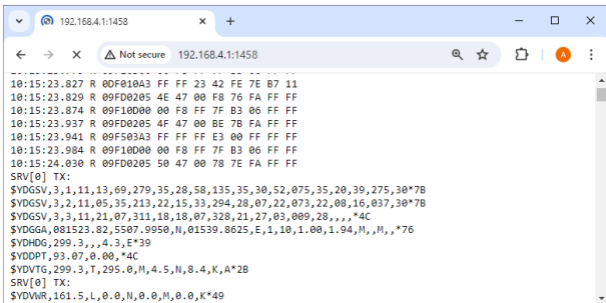$YDVWR,161.5,L,0.0,N,0.0,M,0.0,K*49

Figure 6. Chrome browser with log

IX. Firmware Updates

You can check the current firmware version at login or on the home page of web interface (see Section III) or in the Device information in the list of NMEA 2000 (SeaTalk NG, SimNet, Furuno CAN) devices or in the common list of external devices on the chart plotter (see the third line at Figure 7).

Usually access to this list is located in the «Diagnostics», «External Interfaces» or «External devices» menu of the chart plotter.

We recommend updating the firmware via a laptop or PC. You can download the latest firmware version from our web site: https://www.yachtd.com/downloads/.

You should open the downloaded .ZIP archive with an update and copy the WUPDATE.BIN file to the disk. The README.TXT file inside the archive can contain important information regarding the update.

1. Log in to the web interface.

2. Open the «Firmware Update» page.

3. Click the «Choose File» button and locate the WUPDATE.BIN file on the disk.

4. Click the «Update the firmware» button.

The Firmware upload takes 20 – 40 seconds. After this period, you'll get a message that the update is started. You will see chaotic flashes of the LED for 40 – 60 seconds, and the Gateway will be rebooted when the update procedure is finished.

The firmware update cannot damage the Device and all settings will remain intact (unless otherwise stated in the README.TXT file provided with the update) For example, if the update procedure is interrupted due to power failure, it will be re-started at the next power on.

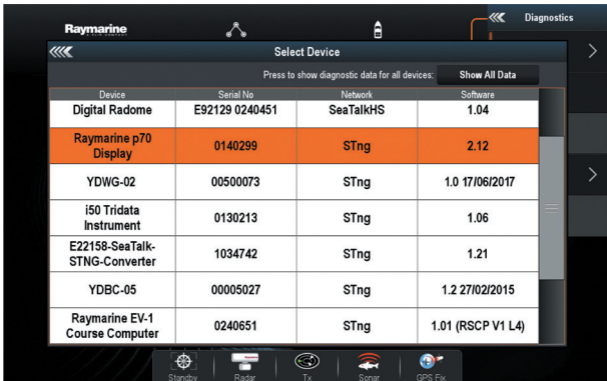You can roll back all firmware updates and return to the factory firmware with hardware reset (see Section VII).

Figure 7. Raymarine c125 MFD devices list with the Device (YDWG-02)

X. NMEA Settings and Autopilot Control

This section describes how to control NMEA 2000 (SeaTalk NG) autopilot from the application using NMEA 0183 protocol and the settings available on the «NMEA Settings» page of the web interface.

1. True wind calculation

The wind sensor always measures apparent wind; true wind angle is calculated using SOG or STW data and true wind direction requires COG or heading. A chart plotter can join all these data and send calculated values to NMEA 2000, but usually TWD, TWA and TWS are not available.

Historically, STW/HDG are used to calculate true wind. However, this is not correct in places with strong current, and the «true» value of true wind can be obtained using the SOG/HDG pair. Therefore, our gateways offer four options: SOG/HDG (if you love truth), SOG/COG (if you have GPS only), STW/HDG (if tradition is most important), or you can disable calculations. In the last case the gateway reports true wind data only if they are calculated by another device available on NMEA 2000 network.

The default setting «Any» means that the gateway will detect what data is available on the network and will calculate true wind data using the best possible option. Please note that true wind is calculated only during conversion from NMEA 2000 to NMEA 0183.

2. Talker ID

You can configure the talker ID (two next characters after $ or ! sign) for NMEA 0183 output sentences. The default setting for the talker ID is «YD» and gateway sentences looks like:

```
$YDWPL,5441.1350,N,02014.8640,E,005*7A
$YDRTE,1,1,c,My Funyy Route,001,002,003,004,005*10
```

3. Autopilot control

Modern autopilots have the following modes:

- **Standby.** In this mode, autopilot is not engaged to the vessel control.
- **Auto.** The autopilot has a fixed course to steer.
- **Wind.** The autopilot steers the boat at a specified angle to the wind.
- **Waypoint.** The autopilot steers the boat to the specified waypoint.
- **Route or Track.** The autopilot steers the boat by a specified route.

The difference in the last two modes is that autopilot not only maintains the right direction to the waypoint, but also tries to follow the line from the previous to the next waypoint.

Note that Gateway server port must be configured to work in both directions («Transmit Only» in factory settings) to allow control of autopilot from the application. When NMEA 2000 autopilot is controlled from an NMEA 0183 application, it must receive:

- position of the destination waypoint (from RMB sentence);
- course from the position to the destination waypoint (APB and/or RMB);
- cross track error, means the distance and direction from the current position to the route (APB and/or RMB and/or XTE).

Depending on the implementation, the NMEA 2000 autopilot can also use the following data (and not only):

- vessel heading (HDG sentence), but in most systems the heading sensor is connected directly to the autopilot;
- rate of turn (ROT sentence);
- position, course and speed over ground (RMC sentence).

To control the autopilot, Gateway should receive APB and RMB sentences from the application. Gateway also needs to have magnetic variation data, which can be obtained from HDG or RMC sentences or from the NMEA 2000 messages (must be turned on in the Gateway settings).

If your NMEA 2000 network has GPS data, it can use data already available on NMEA 2000 and sending of the ROT, HDG and RMC sentences from the application may not be required. It is better to send minimal data from a PC to the NMEA 2000 network if possible.

Depending on the autopilot sensitivity settings, autopilot can control your vessel smoothly or aggressively. The application only provides the situation (where is the waypoint and how far we are from the route), but the course to steer and the rudder angle are defined by the autopilot logic.

Waypoint switching is managed by the application. If the arrival radius is set to 1 NM, application can switch to the next waypoint when the current point is still a mile away. If your route is circular or approximately so, the application can unexpectedly switch from the first point to the last. You should be familiar with your application settings and test how the system works on the open water.

The autopilot can warn you or ask for your confirmation when the application changing the waypoint. It depends on autopilot settings. When the application terminates the navigation, it usually stops sending APB and RMB sentences. Autopilot usually switches to Auto mode and signals about that.

To control Raymarine autopilot:

- Gateway server port must be configured to use the NMEA 0183 data protocol and works in both directions («Transmit Only» in factory settings);
- its support must be turned on in the settings (first setting at the «NMEA Settings» page), because it is turned off by default;
- Raymarine autopilot must be initially set to the Auto mode to be controlled from the application;
- the application must provide APB, RMB and RMC sentences;
- the application should provide an HDG or RMC sentences or using of NMEA 2000 variation must be on in the settings (3rd setting at the «NMEA Settings» page).

When the route or waypoint is activated in the application, autopilot switches to the Track mode from Auto. If automatic confirmations are off (default settings, 2nd setting at the «NMEA Settings» page), the chart plotter and pilot head will ask for the confirmation when waypoint is changing. When the application terminates the navigation, Raymarine autopilot returns to the Auto mode.

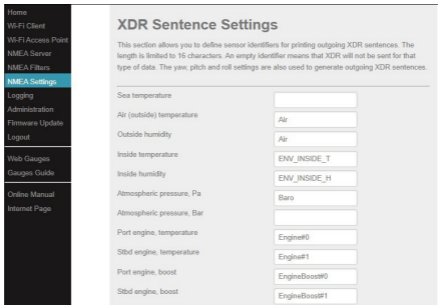It is impossible to switch from Track mode to Auto when the application controls the autopilot, because it will return it to the Track mode after a 5-second delay. To take control in an emergency, switch the autopilot to Standby mode.

4. XDR Settings

In this section you can set identifiers (transducer IDs) for incoming and outgoing XDR sentences.

The XDR sentence is used to transfer data from sensors, tanks, engines, etc.

This sentence contains the sensor's text identifier (name), which was not defined by NMEA Standard until end of 2018. This led to the invention of names by every company on the market. For example, B&G uses «AIRTEMP» to send air temperature data, OpenCPN software uses «TempAir», Maretron uses «ENV_OUTSIDE_T», and the NMEA 0183 Standard 4.11 defines «Air».

Figure 8. XDR settings

With these settings you can define names used in XDR to provide compatibility with software or hardware. The length of the name is limited to 16 characters. An empty name means that data will not be sent in XDR sentence.

For more details about XDR refer to our FAQ: https://www.yachtd.com/faq/.

XI. Web Gauges in the Gateway Web Interface
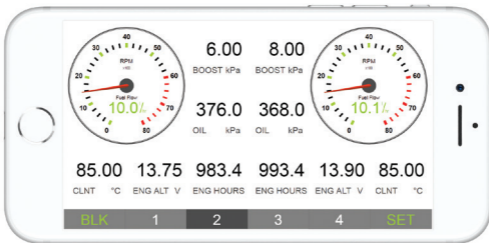
Figure 9. Built-in web gauges (Apple IPhone 8)

The Web Gauges page (WG) allows vessel data real-time monitoring using a web browser on PC, laptop, tablet or smartphone and can replace instrument displays. You can open the WG using the link on the logon page of the gateway's web interface (no authorization required) or, if you are logged in, using the «Web Gauges» menu item. No internet connection or app installation is required.

WG offers five customizable data pages. On mobile devices you can slide pages, or you can use the numeric buttons on the menu (at the bottom of the screen) to choose the active page. Data pages are pre-configured. The first page contains circular gauges for course/speed and AWA/AWS (apparent wind angle and speed), and text data bars with STW, heading, TWS and TWA data. The second page (see Figure 9) is configured

to view twin engine data and contains circular tachometers and text data bars with engine temperature and fuel rate data. The third page contains data bars with position, time, log, sea and air temperature, barometric pressure and depth surface graph with current depth value. The fourth page is not configured and contains no gauges or data bars. The fifth page is preconfigured for autopilot control (see Figure 10). You can change any page's layout and its sets of data bars.

On an IPhone, IPad and Android devices, the address bar and/or menu bar of a web browser can reduce the visible area and overlap WG menu in horizontal or vertical screen orientation. In this case, add WG to the Home Screen (see browser menu) and open it using the WG icon on the Home Screen. The page will then open in full screen mode without browser menus or address bars.

The actual WG guide is available on web interface (the next link after Web Gauges link at the logon page or in the menu of web interface) and online at:

https://www.yachtd.com/products/web_gauges.html.

Most autopilots need a manufacturer proprietary message to activate TRACK mode, and may need to receive some proprietary commands during navigation. This locks the autopilot into the same manufacturer's MFD and pilot head. However, since firmware version 1.70, the Gateway allows to control Yacht Devices autopilot YDAP-04 and Raymarine SeaTalk NG autopilots using Web Gauges (refer to Figure 10).
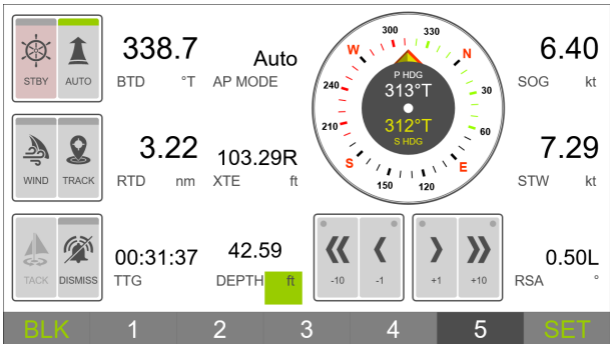
Figure 10. Web Gauges Autopilot control page

To enable Raymarine SeaTalk NG autopilot support in Web Gauges:

1. Server #1 should be configured for bidirectional exchange and NMEA 0183 protocol.

2. On NMEA Settings page you need to enable «Control of Yacht Devices autopilots from NMEA 0183 and Web Gauges». For SeaTalk NG autopilots «Control of Raymarine autopilots from NMEA 0183» also should be enabled.

3. On Web Gauges Autopilot Control page, the «CONTROL/BANK» setting should be set for all buttons as:

   - «5» for Yacht Devices autopilots;

   - «Third Party» for Raymarine autopilots.

4. For Raymarine SeaTalk NG autopilots, in Web-gauges OVERALL SETTINGS set «Third Party Autopilot» as «Raymarine SeaTalk NG».

For more details refer to Application Note on Web Gauges page:
https://www.yachtd.com/products/web_gauges.html

XII. Data Logging and Cloud Services

The gateway is able to record a vessel's data to the internal memory. Recorded data can be downloaded from the web interface (no internet connection required) in GPX (tracks), CSV (spreadsheets) or XML formats, or uploaded to Cloud Services if the gateway has an internet connection. Cloud Services allows easy access to your tracks from home and lets you share your position with family and friends. To learn more about Cloud Services, visit: https://cloud.yachtd.com/.

1. Logging setup

Open the «Logging» page from the menu in the web interface. The page has 3 sections: «Logging», «Download» and «Upload». In the «Logging» section, you can configure interval between points (from 15 seconds to 1 hour) or turn the logging off and configure data set.

With factory settings, data logging is ON with a 5-minute interval between points and «Basic» data set is used. This data set includes GPS position, date/time, GOG, SOG, AWA, AWS, TWA, TWS, TWD, heading, STW and depth. All other available data sets include all data from «Basic»; choose the data set on the «Logging» page to see what additional data are included in the selected data set. Switching the data set does not affect on previously recorded data.

The setting «Do not save points closer than 5 meters apart» reduces track size by filtering out points when the vessel stays in a marina or at anchor. Turn off this setting if you are using Cloud Services for remote live monitoring of environment conditions in marina and/or the boat's systems.

When the memory is full, new points will overwrite old points. Use the button «Clear

all data» before selling the gateway. Recorded data can also be cleared by a hardware reset of the gateway, but a settings reset does not clear it (see Section VII).

2. Data download

To download recorded data from the gateway, you need to set Server #3 to the «Memory» protocol (see Section IV) and open this server in a web browser. If the Device has the address 192.168.4.1 and Server #3 has port address 1458, open the page http://192.168.4.1:1458/ in your browser. Data will be loaded to the browser, and data export page will be shown. On this page you can choose desired format, set options (XML schema for GPX file, column separator for CSV file, preferred units and so on) and download file with data.

Most chart plotters allow import of GPX tracks, and data recording is very useful as a backup if you have forgotten to start track recording on MFD.

Note that export may not work properly on IPads and iPhones with an iOS version prior to v13, with other devices or operating systems no any issues noted.

Data downloading is not very fast, and in the «Download» section of the «Logging» page you can limit the range of downloaded data, for example to the last 30 days. This section does not affect data recording or uploading data to the Cloud Services; you can change this setting at any time.

3. Upload to Cloud Services

The Cloud Service is free, has no limits for age and size of uploaded data, and it is a great backup for your sailing tracks. It also allows sharing your position and tracks to registered users or to everyone via a «secret» link. To use this service, the Gateway must be configured as a Wi-Fi client (see Section III.2) and your Wi-Fi network must

have an internet connection (from time to time at least).

To start, you need to register at https://cloud.yachtd.com/ and get a «Boat key» using the serial number of your Gateway. Once the boat key is entered to the settings in the «Upload» section of the «Logging» page, gateway will upload data to the Cloud Services every 15 minutes if it has more than one non-uploaded point and an internet connection is available.

Please note that you must have GPS position (PGN: 129029 «GNSS Position Data» or PGN: 129025 «Position, Fast Update») and time/date data (PGN: 126992 «System Time») on your NMEA 2000 network, as they are used as a waypoint identifier. Otherwise, you will have message «no waypoints to upload».

Turn on the setting «Do not save points closer than 5 meters apart» in the «Logging» section if you do not want to produce data traffic while the boat is in a marina. A single point using the «Basic Set» takes 32 bytes, and a point from other sets takes 64 bytes to transfer. The upload session requires transferring about 400 bytes in addition to the data size. Therefore, using Cloud Services is not expensive even with a satellite uplink.

The time and status of the last session can be viewed in the «Uploads» section of «Logging» page or in Cloud Services. If you are using a static IP address, take care to configure the right network gateway and DNS addresses in the «IP Address Settings» section of «Wi-Fi Client» page (see Section III.2).

To diagnose problems, use the «Memory» protocol to detect that you actually have recorded points in the gateway's memory and the «Debug» protocol (see Section VIII). In debug output, search for rows starting with «YD CLOUD» (they should appear every 15 minutes if you have non-uploaded data). Example of the output (mixed with NMEA 2000 and Servers data):

```
YD CLOUD: Connecting (DNS: 192.168.4.102, 192.168.4.98)...
YD CLOUD: Connecting to 45.33.127.28 server...
SRV[2] TX:
06:28:22.142 R 1DEFFF02 45 00 00 00 00 00 00 00
```

The rows above mean, that an Internet connection exists (the address of the cloud server was successfully resolved to its IP address). The next lines show the first lines of server's response and connection result:

```
06:17:24.150 R 19FA0402 D5 F0

YD CLOUD: Response:
HTTP/1.1 201 Created
Content-Type: text/html; charset=UTF-8
Server: Microsoft-IIS/7.5
X-Powered-By: PHP/5.6.38
X-Powered-By: ASP.NET
Date: Mon, 07...
YD CLOUD: 2019-10-07 19:40:11 Data uploaded (last point GMT
2016-10-27 08:16:45)
SRV[2] TX:

06:17:24.151 R 19FA0302 FF DA 78 00 A1 00 71 00
```

If you have connectivity problems, please supply our technical support with a diagnostic recording which contains the «YD CLOUD» strings. If your recording has no such strings, check that you have recorded data using the «Memory» protocol.

To turn off data uploading, remove the boat's key from the Device's settings.

APPENDIX A. Troubleshooting

Situation	Possible cause and correction
LED does not signal when NMEA 2000 is turned on	**1. No power supply on the bus.** Check if the bus power is supplied (NMEA 2000 network requires a separate power connection and can not be powered by a plotter or another Device connected to the network). **2. Loose connection in the power supply circuit.** Treat the Device connector with a spray for cleaning electrical contacts. Plug the Device into another connector.
Device does not signal with 5-second interval	Reset Gateway settings and/or perform a hardware reset (see VII). Apply to technical support.
Software application does not work as expected	**1. Check NMEA filters configuration** (see V). **2. Record diagnostics data** (see VIII) and send it with a software screenshot to technical support.
Cannot connect Wi-Fi device to Gateway	**1. Exceeded the number of allowed connections (3) in Access Point mode.** Reboot Gateway to drop all Wi-Fi connections. **2. High load of Gateway.** Switch applications from TCP to UDP protocol.

Situation	Possible cause and correction
Cannot open TCP server port of Gateway in application	**1. Exceeded the number of TCP connections (3) to server.** Configure application to use another server port or UDP. **2. IP address of Gateway changed.** Static IP address is not configured or DHCP server of Wi-Fi router is not configured. Be sure that you can open the web interface with browser, reset Gateway settings in case of failure.
Cannot login to Wi-Fi network or web interface	**Wrong password or authorization settings.** Reset Gateway settings (see VII).
The Device has no waypoints to upload to the Cloud	Check that you have valid GPS position and date/time data in your NMEA 2000 network.
The Device can not connect to the Cloud	1. Check Internet connection. 2. Check that you specified valid Device's serial number in Cloud Boat details. 3. Check that you specified valid Boat key in Device's settings.

APPENDIX B. Device Connectors

V+, V− − Battery 12V; CAN H, CAN L − NMEA 2000 data;
SCREEN − Not connected in the Device.

V−
SCREEN
CAN H
CAN L
V+

CAN H
V−
CAN L
V+
SCREEN

SeaTalk NG
Connector
Female

NMEA 2000
Connector
Male
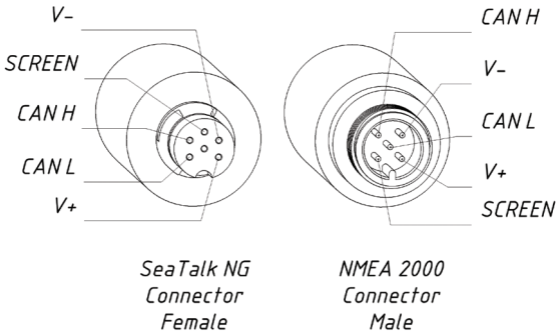
Figure 1. NMEA 2000 connectors of the YDWG-02R and YDWG-02N

APPENDIX C. NMEA 2000 Messages Supported by Device

The Gateway can pass any message from NMEA 2000 to a PC application and in the opposite direction. «No» in the table below means that the Device will not process these messages during service communication with other devices on the network. Note that service communications are not affected by the filter settings of the Device (see Section V).

Appendix D contains the list of messages processed during conversion from NMEA 2000 to NMEA 0183 and from NMEA 0183 to NMEA 2000.

Table 1. Messages supported by Device

Message	Receive	Transmit
ISO Acknowledgment, PGN 59392 (0xE800)	Yes	Yes
ISO Address Claim, PGN 60928 (0xEE00)	Yes	Yes
ISO Request, PGN 59904 (0xEA00)	Yes	No
GNSS Position Data, PGN 129029 (0x1F805)	Yes	No
Local Time Offset, PGN 129033 (0x1F809)	Yes	No
PGN List Group Function, PGN 126464 (0x1EE00)	No	Yes
Product Information, PGN 126996 (0x1F014)	Yes	Yes
System Time, PGN 126992 (0x1F010)	Yes	No

APPENDIX D. Conversions Between NMEA 2000 and NMEA 0183

Table 1. Conversions from NMEA 2000 to NMEA 0183

NMEA 2000 PGN	NMEA 0183 Sentence	Comment
65311 Magnetic Variation (Raymarine Proprietary)	—	See note (4)
126992 System Time	ZDA, GLL	See also PGN 129033
127233 Man Overboard Notification (MOB)	MOB	
127237 Heading/Track Control	APB, HSC, HTD	Use PGN 129284, 129283 if possible
127245 Rudder	RSA	Two rudders supported
127250 Vessel Heading	HDG, HDM, HDT	See note (4)
127251 Rate of Turn	ROT	
127258 Magnetic Variation	—	See note (4)
127488 Engine Parameters, Rapid Update	RPM, XDR, DIN, PGN	See note (6)
127489 Engine Parameters, Dynamic	XDR, DIN	See note (6)
127493 Transmission Parameters, Dynamic	DIN, PGN	See note (6)

Table 1 continued

NMEA 2000 PGN	NMEA 0183 Sentence	Comment
127501 Binary Status Report	DIN	See note (6)
127505 Fluid Level	DIN, PGN	See note (6)
127508 Battery Status	DIN, PGN	See note (6)
128259 Speed, Water referenced	VHW	Also may be used in RMC, VTG
128267 Water Depth	DBT, DBS, DPT	
128275 Distance Log	VLW	
129025 Position, Rapid Update	GLL	Also use PGN 126992 or 129029
129026 COG & SOG, Rapid Update	VTG	Also used in RMC
129029 GNSS Position Data	GGA, GLL, RMC, ZDA	See also PGN 129033
129033 Local Time Offset	—	Time offset is used in ZDA
129044 Datum	DTM	
129283 Cross Track Error	XTE	
129284 Navigation Data	RMB, HSC, BWR, BOD	Use 129283, 129029 if possible

Table 1 continued

NMEA 2000 PGN	NMEA 0183 Sentence	Comment
129285 Navigation - Route/WP information	—	Waypoint names from this message are used in RMB and APB sentences
129291 Set & Drift, Rapid Update	VDR	
129539 GNSS DOPs	GSA	PGN 129540 is also required
129540 GNSS Sats in View	GSV, GRS	PGN 129539, 129029 required
129547 GNSS Pseudorange Error Statistics	GST	
129808 DSC Call Information	DCS, DSE	
130066 Route and WP Service — Route/WP-List Attributes	RTE	Use waypoints from 130067
130067 Route and WP Service — Route — WP Name & Position	WPL	
130074 Route and WP Service — WP List — WP Name & Position	WPL	

Table 1 continued

NMEA 2000 PGN	NMEA 0183 Sentence	Comment
130306 Wind Data	MWD, MWV, VWR, VWT	See note (3). Also used in MDA
130310 Environmental Parameters	XDR, MTW, MDA	See note (1), (5)
130311 Environmental Parameters	XDR, MTW, MDA	See notes (1), (2), (5)
130312 Temperature	XDR, MTW, MDA	See notes (1), (2), (5)
130313 Humidity	XDR, MDA	See notes (1), (2), (5)
130314 Actual Pressure	XDR, MDA	See notes (1), (2), (5)
130316 Temperature, Extended Range	XDR, MTW, MDA	See notes (1), (2), (5)
130578 Vessel Speed Components	VBW	
130816 Proprietary: History Data	BHD	
129038 AIS Class A Position Report	VDM, VDO	AIS VHF messages 1, 2 and 3
129039 AIS Class B Position Report	VDM, VDO	AIS VHF message 18
129040 AIS Class B Extended Position Report	VDM, VDO	AIS VHF message 19

Table 1 continued

NMEA 2000 PGN	NMEA 0183 Sentence	Comment
129041 AIS Aids to Navigation (AtoN) Report	VDM, VDO	AIS VHF message 21
129793 AIS UTC and Date Report	VDM, VDO	AIS VHF messages 4 and 11
129794 AIS Class A Static and Voyage Related Data	VDM, VDO	AIS VHF message 5
129798 AIS SAR Aircraft Position Report	VDM, VDO	AIS VHF message 9
129802 AIS Safety Related Broadcast Message	VDO, VDM	AIS VHF Message 14
129809 AIS Class B «CS» Static Data Report, Part A	VDM, VDO	AIS VHF message 24
129810 AIS Class B «CS» Static Data Report, Part B	VDM, VDO	AIS VHF message 24

Note (1): Air, dew point, inside (saloon), water and exhaust gas temperature, inside and outside humidity, barometric pressure are supported.

Note (2): Only messages with data instance 0 are converted.

Note (3): Device with factory settings perform conversion from true to apparent wind and vice versa. MWV sentence is sending twice (one for relative wind and one for true). See X.1 for details.

Note (4): Magnetic variation is used in RMC, HDT, HDG, VDR, VHW, VTG. Priority of variation PGNs: 127250, 127258, 65311.

Note (5): MDA is sent only when air, dew point or water temperature, or barometric pressure or outside humidity are available. Also contains wind speed and direction.

Note (6): DIN and PGN are wrap NMEA 2000 messages according SeaSmart (v1.6.0) and MiniPlex (v2.0) specifications. Engine revolutions, boost pressure, coolant temperature, hours, fuel rate, alternator voltage are also transmitted in XDR sentence.

Table 2. Conversions from NMEA 0183 to NMEA 2000

NMEA 0183 Sentence	NMEA 2000 PGN	Comment
AAM	129284 Navigation Data	RMB is required
APB	129283 Cross Track Error	Also used in PGN 129284
BOD	129284 Navigation Data	RMB is required
BHR	61184 Proprietary: History Request	
BWR	129284 Navigation Data	RMB is required
DIN	59904 ISO Request 127488 Engine Parameters, Rapid Update 127489 Engine Parameters, Dynamic 127493 Transmission Parameters, Dynamic 127502 Switch Bank Control 127505 Fluid Level 127508 Battery Status	According SeaSmart.Net protocol specification v1.6.0
DBK	128267 Water Depth	When DPT sentence is not available
DBS	128267 Water Depth	When DPT sentence is not available
DBT	128267 Water Depth	When DPT sentence is not available

Table 2 continued

NMEA 0183 Sentence	NMEA 2000 PGN	Comment
DPT	128267 Water Depth	
DSC	129808 DSC Call Information	
DSE	129808 DSC Call Information	DSC is required
DTM	129044 Datum	
GGA	129029 GNSS Position Data	ZDA or RMC are required
GLL	129025 Position, Rapid Update	See note (7)
GNS	129025 Position, Rapid Update	
GRS	129540 GNSS Sats in View	
GSA	129539 GNSS DOPs	
GST	129547 GNSS Pseudorange Error Statistics	
GSV	129540 GNSS Sats in View	Use data from GRS and GSA
HDG	127250 Vessel Heading	
HDM, HDT	127250 Vessel Heading	Use variation and deviation from HDG

Table 2 continued

NMEA 0183 Sentence	NMEA 2000 PGN	Comment
MDA	130311 Environmental Parameters 130314 Actual Pressure 130306 Wind Data	Relative air humidity, air and water temperature, atmospheric pressure, wind data
MOB	127233 Man Overboard Notification (MOB)	
MTW	130311 Environmental Parameters	
MWD	130306 Wind Data	
MWV	130306 Wind Data	Theoretical wind sent as calculated using Heading/Speed through Water
RMB	129283 Cross Track Error 129284 Navigation Data 129285 Navigation — Route/ WP information	Use data from APB; PGN 129284 sent twice with true and magnetic bearings
RMC	126992 System Time 127258 Magnetic Variation 129025 Position, Rapid Update 129026 COG & SOG, Rapid Update	See note (7)
ROT	127251 Rate of Turn	

Table 2 continued

NMEA 0183 Sentence	NMEA 2000 PGN	Comment
RPM	127488 Engine Parameters, Rapid Update	
RSA	127245 Rudder	
RTE	130066 Route and WP Service — Route/WP-List Attributes 130067 Route and WP Service — Route — WP Name & Position	Use data from WPL
VBW	130578 Vessel Speed Components	
VDR	129291 Set & Drift, Rapid Update	
VHW	128259 Speed, Water referenced	
VLW	128275 Distance Log	
VTG	129026 COG & SOG, Rapid Update	
VWR, VWT	130306 Wind Data	
WPL	130074 Route and WP Service — WP List — WP Name & Position	Only waypoints not included to the route (the RTE should be received during 3 seconds after WPL)

Table 2 continued

NMEA 0183 Sentence	NMEA 2000 PGN	Comment
XDR	127505 Fluid Level 127508 Battery Status 130310 Environmental Parameters 130311 Environmental Parameters 130314 Actual Pressure 130316 Temperature, Extended Range	Depend on configuration in «XDR Settings» section
XTE	129283 Cross Track Error	
ZDA	126992 System Time 129033 Local Time Offset	

Table 2 continued

NMEA 0183 Sentence	NMEA 2000 PGN	Comment
VDO, VDM	129038 AIS Class A Position Report	AIS VHF messages 1, 2 and 3
	129039 AIS Class B Position Report	AIS VHF message 18
	129040 AIS Class B Extended Position Report	AIS VHF message 19
	129041 AIS Aids to Navigation (AtoN) Report	AIS VHF message 21
	129793 AIS UTC and Date Report	AIS VHF messages 4 and 11
	129794 AIS Class A Static and Voyage Related Data	AIS VHF message 5
	129798 AIS SAR Aircraft Position Report	AIS VHF message 9
	129802 AIS Safety Related Broadcast Message	AIS VHF Message 14
	129809 AIS Class B «CS» Static Data Report, Part A	AIS VHF message 24
	129810 AIS Class B «CS» Static Data Report, Part B	AIS VHF message 24

Note (7): *The Device provides 50 milliseconds intervals between outgoing NMEA 2000 messages that are generated by more than one NMEA 0183 sentence. For example, a message with PGN 129025 is generated only once if RMC and GLL are received within a 50 millisecond interval, and twice if the time between GLL and RMC is more than 50 milliseconds.*

Note (8): *Sentences with no significant data (or data marked as invalid) may not be translated to NMEA 2000 messages. NMEA 0183 sentences with invalid checksum are ignored.*

APPENDIX E. Format of Messages in RAW Mode

In RAW mode, network messages are converted to plain text format. We recommend that software developers support this format in applications because it is the easiest option. In the terminal window, NMEA 2000 messages look like a log in a chart plotter.

Messages sent from Device to PC have the following form:

```
hh:mm:ss.ddd D msgid b0 b1 b2 b3 b4 b5 b6 b7<CR><LF>
```

where:

- **hh:mm:sss.ddd** — time of message transmission or reception, ddd are milliseconds;
- **D** — direction of the message («R» — from NMEA 2000 to application, «T» — from application to NMEA 2000);
- **msgid** — 29-bit message identifier in hexadecimal format (contains NMEA 2000 PGN and other fields);
- **bo..b7** — message data bytes (from 1 to 8) in hexadecimal format;
- **<CR><LF>** — end of line symbols (carriage return and line feed, decimal 13 and 10).

Example:

```
17:33:21.107 R 19F51323 01 2F 30 70 00 2F 30 70
17:33:21.108 R 19F51323 02 00
17:33:21.141 R 09F80115 A0 7D E6 18 C0 05 FB D5
17:33:21.179 R 09FD0205 64 1E 01 C8 F1 FA FF FF
17:33:21.189 R 1DEFFF00 A0 0B E5 98 F1 08 02 02
17:33:21.190 R 1DEFFF00 A1 00 DF 83 00 00
17:33:21.219 R 15FD0734 FF 02 2B 75 A9 1A FF FF
```

Time of message is UTC time if the Device has received the time from the NMEA 2000 network, otherwise it is the time from Device start.

The format of messages sent from application to Device is the same, but without time and direction field. Outgoing messages must end with <CR><LF>. If the message from application is accepted, passes filters and is transmitted to NMEA 2000, it will be sent back to the application with «T» direction.

For example, the application sends the following sentence to the Device:

```
19F51323 01 02<CR><LF>
```

When this message is sent to the NMEA 2000 network, the Application receives an answer like:

```
17:33:21.108 T 19F51323 01 02<CR><LF>
```

The Application will get no answer if the message filtered or the message syntax is invalid.

The format of NMEA 2000 messages is available in Appendix B of NMEA 2000 Standard, which can be purchased on the site https://www.nmea.org/.